COMMUNICATIONS SYSTEM HAVING DISTRIBUTED DATABASE ARCHITECTURE AND RELATED METHODS

Field of the Invention

[0001]   The present invention relates to the field of communications systems, and, more particularly, to database information storage and retrieval and related methods.

Background of the Invention

[0002]   Computer database systems are frequently used to store important data in an organized fashion. For example, a database may be used to store information relating to a particular account or user for easy access and retrieval. Such information may include user contact or profile information, electronic mail (e-mail) messages, etc.

[0003]   While databases are extremely useful for providing quick access to data, their effectiveness can potentially become diminished as the amount of data to be accessed grows. That is, for database systems in which thousands or even millions of customer records or e-emails are being stored, attempting to simultaneously store and/or access numerous records at the same time

can create severe bottlenecks and, thus, diminish system performance.

[0004]   One approach for addressing this problem is through the use of distributed databases. More particularly, the various account information is distributed or spread across multiple databases, which in turn spreads the access burden across the databases as well and thus reduces bottlenecks. Of course, one challenging aspect of implementing a distributed database system is keeping track of which accounts are associated with which databases. One approach for doing so is to use yet another database, i.e., a central database, that maps the various accounts to their respective account databases. One example of a distributed database system including such a centralized database is disclosed in U.S. Patent No. 5,560,005, for example.

[0005]   Despite such prior art systems, faster and more efficient approaches for accessing data distributed across numerous databases may be required in certain applications.

Summary of the Invention

[0006]   In view of the foregoing background, it is therefore an object of the present invention to provide a communications system providing enhanced access to distributed account databases and related methods.

[0007]   This and other objects, features, and advantages in accordance with the present invention are provided by a communications system which may include a plurality of account databases each for storing information associated with different accounts, and a central database for storing location information associating each account with a respective account

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database. Additionally, the system may also include at least one communications device for accessing account information, and an interface device for receiving an account access request from the at least one communications device for a desired account. Moreover, the interface device may also be for retrieving account location information from the central database for the desired account, and interfacing the at least one communications device with the respective account database associated with the desired account based thereon.

[0008]   The interface device may also advantageously be for caching the account location information and using the cached account location information for subsequently interfacing the at least one communications device with the respective account database. As such, the interface device need not continually access the central database for account location information, which could lead to significant bottlenecks and system performance degradation. Further, since cached account location information is readily available when subsequent access to the desired account is requested, the respective account database may be accessed more quickly as well.

[0009]   In particular, the interface device may include a caching module for caching the account location information. Furthermore, the at least one communications device may have an operating protocol associated therewith. As such, the interface device may further include at least one protocol interface module for communicating with the at least one communications device using the operating protocol. By way of example, the at least one protocol interface module may include one or more of a wireless access protocol (WAP) module,

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a post office protocol (POP) module, and a hypertext
markup language (HTML) module. The interface device may
also include a control module for interfacing the at
least one protocol interface module with the central
and account databases.

[0010] In addition, the central database may further
store shared system setup information. Thus, the
interface device may also retrieve and cache the shared
system setup information for use in interfacing the at
least one communications device with the respective
account database. The at least one communications
device may be one or more mobile wireless
communications devices, and the accounts may be
electronic mail (e-mail) accounts, for example.

[0011] A method aspect of the invention is for
interfacing at least one communications device with a
plurality of account databases each for storing
information associated with different accounts. The
method may include receiving an account access request
from the at least one communications device for a
desired account, and retrieving account location
information associating the desired account with a
respective account database from a central database.
The method may further include interfacing the at least
one communications device with the respective account
database associated with the desired account based upon
the retrieved account location information, and caching
the account location information and using the cached
account location information for subsequently
interfacing the at least one communications device with
the respective account database.

[0012] An interface device in accordance with the
present invention may include a control module and a
caching module, such as those described briefly above.

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A computer-readable medium in accordance with the present invention is also provided and may similarly include a control module and a caching module.

Brief Description of the Drawings

[0013]   FIG. 1 is schematic block diagram of a communications system in accordance with the present invention.

[0014]   FIG. 2 is schematic block diagram illustrating an embodiment of the communications system of FIG. 1 for accessing e-mail accounts.

[0015]   FIG. 3 is flow diagram illustrating a distributed database access method in accordance with the present invention.

Detailed Description of the Preferred Embodiments

[0016]   The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout, and prime notation is used to indicate similar elements in different embodiments.

[0017]   Referring initially to FIG. 1, a communications system **10** in accordance with the present invention illustratively includes a plurality of account databases **11a-11n**. Each account database **11** stores information associated with different accounts to provide a distributed database architecture. By way

of example, the accounts may be user e-mail accounts, and the information associated with each account may be user e-mails. The account databases **11a-11n** may also be used for numerous other types of accounts and information for which databases are traditionally used, such as a corporate database system in which employees access information for different accounts or matters. Moreover, other types of accounts may include customer accounts for storing billing and/or payment information, bank accounts, etc.

[0018] The system **10** also illustratively includes a central database **12** for storing account location information associating each account with a respective account database **11**. Thus, the central database **12** provides a central reference point for determining which account database **11** information for a desired account is located on. This information may be stored in the form of a lookup table, for example.

[0019] In addition to storing account location information, the central database **12** may optionally store any shared system setup information that would be used for accessing the account databases **11a-11n**. Generally speaking, the shared system information would include any information that would otherwise have to be updated individually at each database **11** if not centrally stored, and thus cause access delays resulting in overall system performance degradation.

[0020] Generally speaking, the account information in the account databases **11a-11n** is to be accessed by one or more communications devices **13**. In the case of a corporate computer network communications system, for example, the communications device **13** may be a personal computer (PC) located at a user's desk. Of course, while only one communications device **13** is shown for

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clarity of illustration, it will be appreciated that any number of such communications devices may be used in accordance with the present invention.

[0021]   To interface the communications device **13** with a desired account database **11**, the system **10** also illustratively includes an interface device **15**. The interface device **15** receives an account access request from the communications device **13** for a desired account. The form of the account access request will vary depending upon the type of account being accessed. For an e-mail account, a user or device identification (ID) may be provided, which the interface device **15** uses to determine which e-mail account is to be accessed. Various other types of account access requests will be appreciated by those skilled in the art based upon the type of account information being accessed.

[0022]   Upon receiving an account access request, the interface device **15** retrieves account location information from the central database **12** for the desired account. The interface device **15** then interfaces the communications device **13** with the respective account database **11** associated with the desired account based upon the retrieved account location information.

[0023]   In accordance with the invention, the interface device **15** also caches the retrieved account location information. As such, the interface device **15** may advantageously use the cached account location information for subsequently interfacing the communications device **13** with the respective account database. As such, the interface device **15** need not continually access the central database **12** for account

location information if the communications device **13**
makes fairly regular account access requests.

[0024]   By caching the recently retrieved account
location information, the interface device **15** need not
repeatedly access the central database **12**, which could
cause significant bottlenecks and, thus, system
performance degradation, as will be appreciated by
those skilled in the art. Further, since cached account
location information is readily available when
subsequent access to the desired account is requested,
the respective account database **11** may be accessed more
quickly as well, further improving system performance.

[0025]   The communications system **10'** will now be
further described with reference to an embodiment
thereof for accessing e-mail accounts shown in FIG. 2.
In the illustrated embodiment, the communications
device **13'** may be a user's PC at his home, for example.
The communications device **13'** may communicate with the
interface device **15'** via a direct connection or the
Internet, for example. Moreover, other communications
devices, such as a mobile wireless communications
device **14'**, may communicate with the interface device
15' via a wireless communications network **16'**, for
example, as will be appreciated by those skilled in the
art. By way of example, the mobile wireless
communications device **14'** may be a personal digital
assistant (PDA), cellular telephone, or wireless
enabled laptop computer.

[0026]   Different types or brands of communications
devices will typically use different operating
protocols for accessing information such as e-mails and
Web pages. By way of example, a desktop PC may use
hypertext markup language (HTML) for sending and
receiving e-mails, as it will typically have robust

processing capabilities and a relatively high bandwidth connection to the interface device **15'**. On the other hand, a PDA or cell phone will typically have more limited processing capabilities, and it will be subject to the bandwidth constraints of the wireless communications network **16'**. As such, these types of devices may use the wireless access protocol (WAP), which provides more efficient access therefor.

[0027] Accordingly, since different operating protocols will be used to access the interface device **15'**, the interface device advantageously includes respective protocol interface modules **20'-22'** for interfacing communications devices using respective protocols. That is, each protocol interface module **20'-22'** translates data between a particular operating protocol and a common protocol used by the interface device **15'**. As shown, the module **20'** is a WAP module, the module **21'** is a post office protocol (POP) module, and the module **22'** is an HTML module. Of course, other protocol interface modules may be included for different operating protocols as well.

[0028] The interface device **15'** further illustratively includes a control module **23'** for communicating with the protocol interface modules **20'-22'** using the common protocol, and for accessing the central database **12'** and account databases **11a'-11n'**, as described above. By way of example, the control module **23'** may be implemented as an application program interface (API), as will be appreciated by those skilled in the art. The interface device **15'** may also include a caching module **24'** for caching the retrieved account access information (and, optionally, system setup information) in a cache memory (not shown). Various caching approaches may be used, one of which is

a rolling cache in which newly retrieved information displaces the oldest information in the cache once it reaches capacity. The particular cache size and caching approach used may vary from one implementation to another to provide desired performance, as will be appreciated by those skilled in the art.

[0029]   In one embodiment, the interface device **15'** may be a server (e.g., a corporate or Internet service provider (ISP) server), and the modules **20'-24'** may be implemented as software modules thereon. It should also be noted that although they are shown as being separate for clarity of illustration, the various functions of the modules **20'-24'** could be implemented in a single software product or bundle, for example. It should also be noted that the interface device **15'** may be implemented on several servers or other devices, and the various modules **20'-24'** may be spread across the servers, as will be appreciated by those skilled in the art. Further, the interface device **15'** need not be on the same network as the account database **11a-11n** (e.g., they may communicate over the Internet).

[0030]   Turning now to FIG. 3, a method aspect of the invention for interfacing one or more communications devices **13** with a plurality of account databases **11a-11b** each for storing information associated with different accounts is now described. Beginning at Block **30,** an account access request is received from the communications device **13** for a desired account, at Block **32.** If account location information associating the desired account with a respective account database **11** is not already cached, then this information is retrieved from the central database **12,** at Blocks **34** and **36,** and the retrieved account location information is cached, at Block **38,** as previously described above.

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[0031] Once the account location information is retrieved (whether from the central database **12** or from cache, at Block **35**, if available), the method further includes interfacing the communications device **13** with the respective account database **11** associated with the desired account based upon the retrieved account location information, as described above, at Block **40**, thus concluding the illustrated method (Block **42**). Of course, it should be noted that the caching operation may take place after interfacing of the communications device **13** and the account database **11** in some embodiments. Moreover, system startup information may also be retrieved and cached, as noted above.

[0032] The invention also relates to a computer-readable medium having computer-executable instructions for interfacing at least one communications device **13'** with a plurality of account databases **11a'-11n'** each for storing information associated with different accounts. The computer-readable medium may include a control module **23'** for receiving an account access request from the at least one communications device **13'** for a desired account, retrieving account location information associating the desired account with respective account databases **11a'-11n'** from a central database **12'**, and interfacing the at least one communications device **13'** with the respective account databases **11a'-11n'** associated with the desired account based thereon. A caching module **24'** caches the account location information, and the control module **23'** uses the cached account location information for subsequently interfacing the at least one communications device **13'** with the respective account database, as previously described above.

[0033]   Many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is understood that the invention is not to be limited to the specific embodiments disclosed, and that modifications and embodiments are intended to be included within the scope of the appended claims.